

Supplementary Materials for:

**Redistributive Politics and Market Efficiency:
An Experimental Study**

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ABSTRACT

This document contains supplementary materials for the paper *Redistributive Politics and Market Efficiency: An Experimental Study*. It is organized in the following way: Section 1 consists of a sample of the instructions used in the experiment, and Section 2 contains the code used to simulate the zero-intelligence market trading described in the paper.

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1. Experimental instructions

These instructions are translated from the original German version and contain all possible stages of the game: double auction market, lobbying, tax competition, and election stage. Instructions for treatments with fewer stages use identical parts of the present instructions, and they are available from the authors on request. The experiment was programmed in z-Tree (Fischbacher 2007).

General instructions

Welcome to today's experiment. You will receive 2.50 € for participation. Depending on your *own decisions* and the *decisions of other participants*, you can earn more money. During the experiment, you have the opportunity to collect *points*. **17 points are worth 1 €**. At the end of the experiment, your total points will be exchanged to € and be paid to you in cash, together with your participation fee. The payment remains *anonymous*, that is, we do not inform any other participant about your payment.

Note that you are not allowed to ask questions *aloud* or communicate with other participants during the entire experiment. If you have questions, please raise your hand. One of the experimenters will come to you and answer your questions.

Part I and part II

The experiment consists of two parts (*part I* und *part II*). At the moment, you only have the instruction for part I on hand. After part I has finished, you will receive the instructions for part II.

Instructions part I

Decisions rounds and Your group

There are *10 decision rounds*. At the *beginning of the experiment*, the computer will *randomly* divide the participants into *groups of 12 participants*. Your *group* consists of you and eleven other participants. No matter in which round you are, you and the other

participants in your group will never be introduced to each other. **The composition of your group does not change during the entire experiment.** You do not interact in any way with other groups in this experiment!

Candidates and Members

At the beginning of the experiment, the computer will randomly divide your group into 2 candidates ("candidate 1" and "candidate 2") and 10 members ("member 1", ..., "member 10"). Each participant in your group has the same probability of becoming a candidate or a member. At this point, you will be informed about your own type, candidate or member, but not about the types of other participants in your group. The same holds for other participants in your group. (You can always see your own type in the top right corner of the screen.) **Please note that your type candidate or member will never change during the entire experiment.**

Different phases of a decision round

Each decision round consists of 4 phases ("market", "transfers to candidates", "transfers between members" and "voting"). The two candidates only make decisions in the phase 'transfers between members' and the ten members only make decisions in the three phases 'market', 'transfers to candidates', and 'voting'. (You can always see the current phase in the top left corner of the screen.) Precisely what kind of decisions these are and how these influence your payment and the payment of other participants in your group will be explained in the following sections in detail for each phase.

Phase 'market'

In this phase, the 10 members make decisions in a market. The two candidates do *not* make decisions in this phase and only watch the market activity.

Sellers and buyers:

At the beginning of the experiment, the computer will randomly divide the 10 members into 5 sellers and 5 buyers. Each member has the same probability of becoming a seller or

buyer. This division does not change during the entire experiment. That is, no matter in which round a member is, he or she is always a seller or a buyer in the 'market' phase.

Goods, costs, and maximum willingness to pay:

Each seller can *sell 2 units* of an 'imaginary' good, and each buyer can *buy 2 units* of the good. In the following, we denote these goods for each seller and buyer by '*good 1*' and '*good 2*'. *At the beginning of the experiment*, each seller will be assigned *costs* for the two goods. Similarly, *at the beginning of the experiment* each buyer will be assigned a *maximum willingness to pay* for each of the two goods. For each seller and buyer, the respective costs and willingnesses to pay do not change during the entire experiment. An individual's costs or willingnesses to pay are only known to the respective seller and buyer and are different between the sellers and between the buyers.

Market periods, asks, and bids:

In each round, there is one *market period* in the 'market' phase. Each market period lasts *2 minutes*. During a market period, all sellers can make *asks* and all buyers can make *bids*, visible to everyone. Each seller can first sell his or her good 1 (with *lower* costs) and can only thereafter sell good 2 (with *higher* costs). Each buyer can first buy good 1 (with *higher* maximum willingness to pay) and can only thereafter buy good 2 (with *lower* maximum willingness to pay). Sellers can only sell and buyers can only buy. An *ask* must always be *lower* than the current ask on the market (but larger or equal to the own costs). A *bid* must always be *larger* than the current bid in the market (but lower or equal to the own maximum willingness to pay).

Transactions:

A *transaction* occurs if *either* a seller accepts a bid *or* a buyer accepts an ask (the transaction price is then equal to the accepted amount of the bid or ask, respectively).

Earnings from the market:

Earnings of sellers for each sold good:

- For each *sold* good, a seller earns points that are calculated as the difference between the transaction price and the costs of this good:

(Earnings from sold good = transaction price – costs).

- For each good that is *not* sold, a seller earns nothing (**0 points**). Hence, there are *no* costs for a good if it is not sold!

Earnings of buyers for each good bought:

- For each *bought* good, a buyer earns points that are calculated as the difference between the maximal willingness to pay for this good and the transaction price:

(Earnings from bought good = maximal willingness to pay – transaction price).

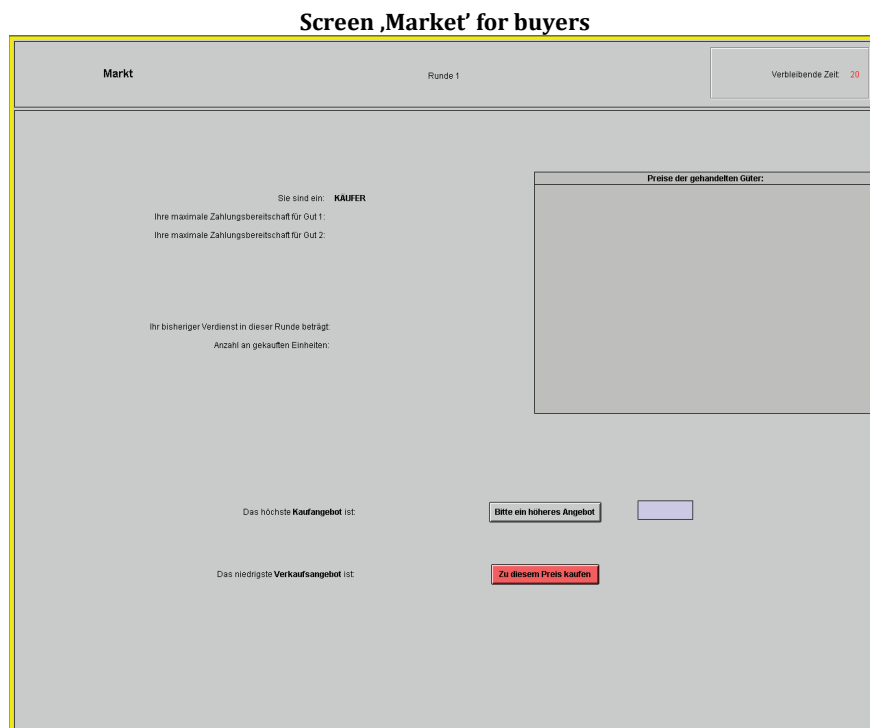
- For each good that is *not* bought, a buyer earns nothing (**0 points**).

In this phase, *candidates* can not earn any points.

The following screens (“*Seller*” and “*Buyer*”) can be seen during the experiment by the sellers and buyers, respectively (candidates see a screen that shows the current earnings of members).



A seller who wants to accept the current bid in the market must press the button “Sell at this price”. If the seller wants to make a new ask, he or she can do this in the input field to the right of the button “Please make a smaller ask”, and confirm his or her decision by clicking the button.



A buyer who wants to accept a current ask in the market must press the button “Buy at this price”. If the buyer wants to make a new bid, he or she can do this in the input field to the right of the button “Please make a higher bid”, and confirm his or her decision by clicking the button.

Phase ‘Transfers to candidates’

In this phase, once again, only the ten members make decisions. Candidates do not make decisions in this phase. At the beginning of the phase, *all* participants in your group (candidates and members) will be informed about each member’s market earnings. Each member will be asked to transfer an amount (in points) to candidate 1 *and/or* to candidate 2, with the restriction that the sum of transfers to both candidates cannot exceed the own market earnings. Hence, *in total*, each member can transfer *any* amount between 0 points (0

inclusive) and his or her own market earnings (this point-amount inclusive) to the two candidates together. As long as this restriction is fulfilled, a member can transfer *any possible combination of points* to the two candidates. While making their decisions, no member knows the decision of any other member in the group.

The following screen *Transfers to candidates* can be seen by the ten members in the experiment.

The screenshot displays the 'Überweisungen an Kandidaten' interface. At the top, it indicates 'Runde 1' and 'Sie sind MITGLIED 4'. The main content area shows a table of market earnings for 10 members. The earnings for 'Sie' (Member 4) are highlighted. Below the table, there is a prompt 'Wie viele Punkte möchten Sie überweisen an:' followed by two input fields for 'KANDIDAT 1?' and 'KANDIDAT 2?'. An 'Eingabe' button is located below the input fields.

Mitglied	Verdienst
Mitglied 1	
Mitglied 2	
Mitglied 3	
Sie	
Mitglied 5	
Mitglied 6	
Mitglied 7	
Mitglied 8	
Mitglied 9	
Mitglied 10	

Der durchschnittliche Verdienst ist:

Wie viele Punkte möchten Sie überweisen an:

KANDIDAT 1? KANDIDAT 2?

On the screen, members can see their *own market earnings* (Line “You”), the *market earnings of the other nine members*, and the *average market earnings of all members*. Below, the members are asked to decide on their transfers to the two candidates. This can be done by entering the chosen amount in the input fields for candidate 1 and candidate 2, respectively. The transfers must be confirmed by clicking the “Enter” button.

Phase ‘Transfers between members’

In this phase, only the two candidates (candidate 1 and candidate 2) make decisions. Members do not make decisions in this phase. After all members have made their decisions in the phase ‘transfers to candidates’, both candidates will be informed about these decisions. Then, each candidate will be asked to choose a *percentage between 0 and 100* (0

and 100 inclusive). While candidates choose their percentages, they do not know the other candidate's decision.

The percentage determines the amount of transfers (in points) *between* members, where some members must pay points and other members receive points. The transfer of *each member* is calculated as follows:

$$\text{Transfer of member} = \text{percentage} \times (\text{average market earnings} - \text{own market earnings}).$$

There are three possible situations for a member:

- 1) The transfer of a member is **negative** (he or she must pay a point-amount), if the own market earnings are **greater** than the average market earnings of all members.
- 2) The transfer of a member is **positive** (he or she receives a point-amount), if the own market earnings are **smaller** than the average market earnings of all members.
- 3) The transfer of a member is **equal to zero** (he or she neither pays nor receives a point-amount), if the own market earnings are **equal to** the average market earnings of all members.

There are two extreme cases: A percentage of 0 results in no transfers between members (the market earnings of members do not change). With a percentage of 100, the earnings change such that all members have the same after-transfer earnings (which are equal to the average market earnings of all members). Please note that the after-transfer earnings are not necessarily the final earnings of the current round because possible transfers to the candidates still need to be subtracted.

Which percentage, the one chosen by candidate 1 or by candidate 2, finally determines the transfers between the members, will be explained in more detail in the next phase, "voting".

The following screen *Transfers between members* can be seen by both candidates in the experiment.

Transfers zwischen Mitgliedern Runde 1 Sie sind KANDIDAT 1

Verdienste aus Markt der Mitglieder und deren Überweisungen an die Kandidaten.

Mitglied	Überweisungen an Sie	Überweisungen an den anderen Kandidaten	Verdienst aus dem Markt	Verdienst nach Transfers zwischen Mitgliedern mit IHRER Prozentzahl
Mitglied 1				
Mitglied 2				
Mitglied 3				
Mitglied 4				
Mitglied 5				
Mitglied 6				
Mitglied 7				
Mitglied 8				
Mitglied 9				
Mitglied 10				

Der durchschnittliche Verdienst aus Markt aller Mitglieder ist:

Bitte wählen Sie eine Prozentzahl
 Klicken Sie erst auf den Button **Berechne Verdienste**, um zu sehen, wie sich Ihre Prozentzahl auf die Verdienste der Mitglieder auswirkt.

Ihre Prozentzahl: %

Ihr Verdienst, wenn Sie weniger Stimmen als der andere Kandidat erhalten:
 Ihr Verdienst, wenn Sie mehr Stimmen als der andere Kandidat erhalten:

Klicken Sie bitte auf **Eingabe**, wenn Sie sich für eine Prozentzahl entschieden haben.

The screen contains the following information for candidates: the *transfers of each member, respectively to him- or herself* (column “Transfers to you”) and *the other candidate* (column “Transfers to other candidate”), the *market earnings of each member* (column “Market earnings”) and below, the *average market earnings* of all members. To the right below the table, a candidate can see her *earnings* in case he or she receives *fewer* votes than the other candidate in the voting phase (= Sum of transfers + 15 points) and in case he or she receives *more* votes than the other candidate (= Sum of transfers + 25 points) (this will be explained in more detail in the instructions for the phase “voting”). At the bottom left, the candidates can enter their chosen percentages in the input field. Thereafter, they must first click the *button “Calculate earnings”*, which will then also appear in the right column “Earnings after transfers between members with your percentage” in the table. Please note that these earnings of the members do not include their possible transfers to the candidates (see column “Transfers to you” and “Transfers to the other candidates”). If the candidate does no longer want to change his or her chosen percentage, he or she must confirm by clicking the *“Enter” button*.

Phase 'voting'

In this phase, only the ten members make decisions. Candidates do not make decisions in this phase. All members are asked to vote for either *candidate 1* or *candidate 2*. Members make their own decisions and do not know the decisions of any other members. After all members have voted, the computer calculates the *number of votes for candidate 1* and the *number of votes for candidate 2* and compares both numbers. The candidate with **more** votes receives **25 points**, and his or her percentage chosen in phase “Transfers between members” determines the point-transfers between the members. The candidate with **fewer** votes receives **15 points**, and his or her chosen percentage will not be considered.

The following screen *Voting* can be seen by the ten members in the experiment.

The screen contains the following information for the members: The chosen *percentage of candidate 1 and candidate 2*, respectively (upper part of the screen) and in row “You”, the *own transfers to candidate 1 and candidate 2* (column “Transfers to candidate 1” and “Transfers to candidate 2”), the *own market earnings* (column “Market earnings”) and *earnings after transfers, if candidate 1 and candidate 2 receives more votes*, respectively (columns “Earnings after transfers between members if candidate 1 wins” and “Earnings

after transfers between members if candidate 2 wins”). Members receive the same information about each of the other members. At the bottom of both columns on the right, members can see their *earnings in this round* (earnings after transfers *and* after subtracting his or her potential transfers to candidates) for the cases that candidate 1 or candidate 2 wins, respectively. The members’ decisions on whether to vote for candidate 1 *or* for candidate 2 are made by clicking the *button “Candidate 1”* or the *button “Candidate 2”* at the lower right part of the screen. While members make their decisions, the candidates see a similar screen (without the two decision buttons “Candidate 1” and “Candidate 2”).

After all members have made their decisions, both candidates and all members will be informed about the result of the ‘voting’ phase. All participants in your group can see the *number of votes for candidate 1* and the *number of votes for candidate 2*, who of the two candidates has won, and the *own round earnings* in points (and the composition of these earnings). The round earnings of candidates consists of the sum of transfers received from the members and the 25 points or 15 points if the candidate wins or does not win, respectively. The round earnings of members consist of the market earnings minus possible transfers to the candidates and minus or plus possible transfers according to the percentage of the winning candidate.

Further procedures of part I

Before we will begin with part I, we will conduct a “Quiz”. *Please fill out the quiz*. The quiz will make sure that all participants are familiar with the instructions of part I. *Please raise your hand* if you have questions about the instructions of part I or if you have *finished the quiz*. One of the experimenters will come to you and answer your questions or check your answers to the quiz. Please wait until all participants have finished the quiz. Only then will we begin with part I of the experiment, in which you can earn points.

Control questions

Please answer the following questions.

- 1) The composition of your group does not change across rounds.
Correct () Incorrect ()
- 2) Your group consists of 2 candidates and 10 members during the entire experiment.
Correct () Incorrect ()
- 3) Your type (candidate or member) and the types of the other participants in your group do not change during the entire experiment.
Correct () Incorrect ()
- 4) The experiment consists of 4 phases, which proceed in the following order. Please tick the phases in which candidates and members make decisions.

	Candidates	Members
- Markets	()	()
- Transfers to candidates	()	()
- Transfers between members	()	()
- Voting	()	()
- 5) Each seller will be assigned costs for good 1 and good 2 and each buyer will be assigned a maximal willingness to pay for good 1 and good 2. These values differ between sellers and between buyers, respectively, and do not change across rounds for the respective members.
Correct () Incorrect ()
- 6) Suppose you are a member, and a buyer in the 'market' phase. Your maximum willingness to pay for buying good 1 is 65 points and that of good 2 is 45 points. You only buy one good in the market at a price of 55 points. What are your market earnings?
- 7) Suppose you are a member, and a seller in the 'market' phase. Your costs for good 1 are 20 points and those for good 2 are 35 points. You sell both goods on the market; good 1 at a price of 50 points and good 2 at a price of 45 points. What are your market earnings?

- 8) Suppose you are a member and your market earnings are 40 points. From these, you want to transfer 10 points to candidate 1 and 5 points to candidate 2. Is this possible?
Yes () No ()
- 9) Suppose you are a member and your market earnings are 15 points. From these, you want to transfer 7 points to candidate 1 and 10 points to candidate 2. Is this possible?
Yes () No ()
- 10) Suppose you are candidate 1 and choose in the phase 'transfers between members' a percentage of 50%. The average market earnings of all members are 25 points. What is the transfer amount for member 2 who has market earnings of 45 points, if you receive more votes than candidate 2? And what is the transfer amount for member 3 who has market earnings of 15 points?
- 11) Suppose you are candidate 2. In the 'voting' phase, there were three votes for candidate 1 and seven votes for yourself. The sum of transfers in the phase 'transfers to candidates' is 40 points for candidate 1 and 30 points for yourself. Candidate 1 has chosen a percentage of 40% in the phase 'transfers between members' and you have chosen a percentage of 100%. The average market earnings of all members are 23 points. What are the earnings after transfers between members of the ten members (without considering possible transfers to the candidates)? What are the round earnings of candidate 1 and candidate 2?
- 12) Suppose candidate 1 has chosen a percentage of 0% in the phase 'transfers between members' and receives more votes in the 'voting' phase than candidate 2. The average market earnings of all members are 25 points. Member 5 has market earnings of 17 points and has transferred 3 points in total to the candidates. What are the round earnings of member 5? And what would his or her round earnings be if candidate 1 had chosen a percentage of 50% and had won in the 'voting' phase?

2. Zero-intelligence trading simulation

Below is the code we used to simulate the double-auction market with random players as in Gode and Sunder (1993). The description of the procedure used is available in Appendix B of the paper. The simulation is programmed for Visual Basic for applications and is set to run within Microsoft Excel (version 2003 or later). The Excel file should contain three black sheets titled: Profit, Trades, and Results. Moreover, it should contain a sheet named PostsDist in which the distribution X (see Appendix B). The Excel file used is available with the experimental dataset.

Code

```
Sub MainSimulation()
```

'Note: Define all variables

```
    Dim simnum As Long, pricenum As Integer, tradenum As Integer, x As Integer, bidnum As Integer, asknum As Integer, MaxValue As Integer, MinCost As Integer, ActivePlayer As Integer, MaxPosts As Integer, Buyer(1 To 5, 0 To 2) As Integer, Seller(6 To 10, 0 To 2) As Integer, GoodsLeft(1 To 10) As Integer, BuyerPrice(1 To 2) As Integer, SellerPrice(1 To 2) As Integer, RndPrice As Integer, AvgAsk As Variant, AvgBid As Variant
```

'Note: Set random seed and clear sheets for data generation

```
    Randomize  
    Sheets("Trades").Cells.ClearContents  
    Sheets("Profit").Cells.ClearContents  
    Sheets("Trades").Range("A1") = "Trades"  
    Sheets("Trades").Range("B1") = "Prices"  
    Sheets("Trades").Range("A1").Offset(0, 12) = "Avg. Ask"  
    Sheets("Trades").Range("A1").Offset(0, 13) = "Avg. Bid"  
    Sheets("Profit").Range("A1") = "Posts"  
    Sheets("Profit").Range("B1") = "Marginal Earnings"
```

'Note: Introduce the buyers' values and the sellers' costs

```
    Buyer(1, 2) = 80
```

Buyer(1, 1) = 72
Buyer(2, 2) = 88
Buyer(2, 1) = 52
Buyer(3, 2) = 67
Buyer(3, 1) = 37
Buyer(4, 2) = 62
Buyer(4, 1) = 42
Buyer(5, 2) = 57
Buyer(5, 1) = 47
For x = 1 To 5
 Buyer(x, 0) = 0

Next x

Seller(6, 2) = 24
Seller(6, 1) = 30
Seller(7, 2) = 18
Seller(7, 1) = 48
Seller(8, 2) = 36
Seller(8, 1) = 61
Seller(9, 2) = 40
Seller(9, 1) = 57
Seller(10, 2) = 44
Seller(10, 1) = 53
For x = 6 To 10

 Seller(x, 0) = 100

Next x

'Note: Simulation starts for 50,000 periods

For simnum = 1 To 50000

'Note: Initiate market variables

For x = 1 To 10

GoodsLeft(x) = 2

Next x

MaxValue = 88

MinCost = 18

BuyerPrice(1) = 18

BuyerPrice(2) = 0

SellerPrice(1) = 88

SellerPrice(2) = 0

tradenum = 1

pricenum = 1

'Note: Draw the maximum number of posts from the distribution X

MaxPosts = Int(240 * Rnd + 1)

Do Until MaxPosts <= Sheets("PostsDist").Range("C1").Offset(pricenum, 0).Value

pricenum = pricenum + 1

Loop

MaxPosts = Sheets("PostsDist").Range("A1").Offset(pricenum, 0).Value

pricenum = 1

bidnum = 1

asknum = 1

AvgAsk = 0

AvgBid = 0

'Note: Run period until there are no feasible trades

Do Until MaxValue <= MinCost

'Note: Activate a buyer/seller

ActivePlayer = Int(10 * Rnd + 1)

If GoodsLeft(ActivePlayer) > 0 Then

'Note: If buyer or seller has goods left then generate a random bid/ask

If ActivePlayer <= 5 Then *'Note: Buyer activated*

RndPrice = Int((Buyer(ActivePlayer, GoodsLeft(ActivePlayer)) -
 BuyerPrice(1) + 1) * Rnd + BuyerPrice(1))

'Note: If the bid is higher than the current one then replace it

If RndPrice > BuyerPrice(1) + 0.5 Then

BuyerPrice(1) = RndPrice

BuyerPrice(2) = ActivePlayer

AvgBid = (RndPrice + AvgBid * (bidnum - 1)) / bidnum

bidnum = 1 + bidnum

pricenum = 1 + pricenum

End If

ElseIf ActivePlayer > 5 Then *'Note: Seller is activated*

RndPrice = Int((SellerPrice(1) - Seller(ActivePlayer, GoodsLeft(ActivePlayer))
 + 1) * Rnd + Seller(ActivePlayer, GoodsLeft(ActivePlayer)))

'Note: If the ask is lower than the current one then replace it

If RndPrice < SellerPrice(1) - 0.5 Then

SellerPrice(1) = RndPrice

SellerPrice(2) = ActivePlayer

AvgAsk = (RndPrice + AvgAsk * (asknum - 1)) / asknum

asknum = 1 + asknum

pricenum = 1 + pricenum

End If

End If

'Note: If the new bid (ask) is higher (lower) than the posted ask (bid) then make transaction

If BuyerPrice(1) > SellerPrice(1) Then

If ActivePlayer <= 5 Then *'Note: Record trade at the buyers bid*

Sheets("Trades").Range("A1").Offset(simnum, tradenum) = SellerPrice(1)

Sheets("Profit").Range("A1").Offset(simnum, tradenum * 2 - 1) =

Buyer(BuyerPrice(2), GoodsLeft(BuyerPrice(2))) - SellerPrice(1)

```

    Sheets("Profit").Range("A1").Offset(simnum, tradenum * 2) =
        SellerPrice(1) - Seller(SellerPrice(2), GoodsLeft(SellerPrice(2)))
Else 'Note: Record trade at the sellers ask
    Sheets("Trades").Range("A1").Offset(simnum, tradenum) = BuyerPrice(1)
    Sheets("Profit").Range("A1").Offset(simnum, tradenum * 2 - 1) =
        Buyer(BuyerPrice(2), GoodsLeft(BuyerPrice(2))) - BuyerPrice(1)
    Sheets("Profit").Range("A1").Offset(simnum, tradenum * 2) =
        BuyerPrice(1) - Seller(SellerPrice(2), GoodsLeft(SellerPrice(2)))
End If

```

'Note: Calculate the remaining goods of the buyers and sellers and reset the posted prices

```

GoodsLeft(SellerPrice(2)) = GoodsLeft(SellerPrice(2)) - 1
GoodsLeft(BuyerPrice(2)) = GoodsLeft(BuyerPrice(2)) - 1
BuyerPrice(1) = 18
BuyerPrice(2) = 0
SellerPrice(1) = 88
SellerPrice(2) = 0
tradenum = tradenum + 1

```

'Note: Check whether there are still feasible trades

```

MaxValue = 0
For x = 1 To 5
    If Buyer(x, GoodsLeft(x)) > MaxValue Then MaxValue = Buyer(x,
        GoodsLeft(x))
Next x
MinCost = 100
For x = 6 To 10
    If Seller(x, GoodsLeft(x)) < MinCost Then MinCost = Seller(x, GoodsLeft(x))
Next x
End If
End If

```

'Note: Stop after too much trading activity

If pricenum >= MaxPosts Then

 MaxValue = 0

 MinCost = 100

End If

Loop

'Note: Period had ended, record aggregate period statistics

Sheets("Trades").Range("A1").Offset(simnum, 0) = tradenum - 1

Sheets("Profit").Range("A1").Offset(simnum, 0) = pricenum - 1

Sheets("Trades").Range("A1").Offset(simnum, 12) = AvgAsk

Sheets("Trades").Range("A1").Offset(simnum, 13) = AvgBid

Next simnum

End Sub

References

Fischbacher, Urs. 2007. "Z-tree: Zurich toolbox for ready-made economic experiments."

Experimental Economics 10: 171-78.

Gode, Dhananjay K., Shyam Sunder. 1993. "Allocative efficiency of markets with zero-intelligence traders: Markets as a partial substitute for individual rationality." *Journal*

of Political Economy 101: 119-37.